

What is claimed is:

1. An implantable cardiac rhythm management device, comprising:
 - 5 a ventricular sensing channel for sensing ventricular depolarizations and generating a ventricular sense when a depolarization exceeds a specified threshold;
 - a ventricular shock channel for delivering a shock pulse;
 - a controller for detecting ventricular fibrillation from the rate of ventricular senses in the ventricular sensing channel;
 - 10 a thoracic impedance channel for detecting respiratory activity;
 - a diaphragmatic pacing channel for delivering diaphragmatic pacing pulses;
 - and,
 - wherein the controller is programmed to cause delivery of a shock pulse when ventricular fibrillation is detected and delivery of a diaphragmatic pacing pulse when
 - 15 no respiratory activity is detected.
2. The device of claim 1 wherein the diaphragmatic pacing channel is also used for delivering cardiac pacing pulses, a diaphragmatic pacing pulse being of higher energy than a cardiac pacing pulse.
- 20 3. The device of claim 2 wherein a diaphragmatic pacing pulse is on the order of 10 to 30 volts.
4. The device of claim 1 wherein the controller is programmed to begin charging
- 25 an output capacitor of the ventricular shock channel when ventricular fibrillation is detected and to deliver a diaphragmatic pacing pulse while the output capacitor is charging if respiratory arrest is also detected.

5. The device of claim 1 wherein the controller is programmed to deliver a diaphragmatic pacing pulse when both respiratory arrest and ventricular fibrillation are detected only after one or more shock pulses are unsuccessful in terminating the ventricular fibrillation.

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6. The device of claim 1 wherein the controller is programmed to deliver a diaphragmatic pacing pulse during a ventricular refractory period after a ventricular sense if respiratory arrest is detected while no ventricular fibrillation is present.

10 7. The device of claim 1 wherein the controller is programmed to:
begin charging an output capacitor of the ventricular shock channel when ventricular fibrillation is detected and to deliver a diaphragmatic pacing pulse while the output capacitor is charging if respiratory arrest is also detected; and,
deliver a diaphragmatic pacing pulse during a ventricular refractory period after
15 a ventricular sense if respiratory arrest is detected after successful termination of ventricular fibrillation.

8. A cardiac rhythm management device, comprising:
means for monitoring ventricular activity in order to detect ventricular
20 fibrillation;
means for monitoring respiratory activity;
means for delivering shock therapy upon detection of ventricular fibrillation;
and,
means for delivering diaphragmatic pacing upon detection of respiratory arrest.

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9. The device of claim 8 further comprising means for delivering diaphragmatic pacing during ventricular fibrillation while the shock therapy delivering means prepares to deliver a shock pulse.

10. The device of claim 8 further comprising means for delivering diaphragmatic pacing during a ventricular refractory period if ventricular fibrillation is not present.

11. A method for treating cardiac arrest by an implantable cardiac device,
5 comprising:

monitoring a ventricular sensing channel in order to detect ventricular fibrillation;

monitoring a thoracic impedance channel in order to detect respiratory arrest;

delivering shock therapy through a ventricular shock channel upon detection of
10 ventricular fibrillation; and,

delivering diaphragmatic pacing upon detection of respiratory arrest.

12. The method of claim 11 wherein diaphragmatic pacing is delivered as pacing pulses to the phrenic nerve.

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13. The method of claim 12 where the pacing pulses are on the order of 10 to 30 volts.

14. The method of claim 12 further comprising beginning to charge an output
20 capacitor of the ventricular shock channel when ventricular fibrillation is detected and to deliver a diaphragmatic pacing pulse while the output capacitor is charging if respiratory arrest is also detected.

15. The method of claim 11 further comprising deliver a diaphragmatic pacing
25 when both respiratory arrest and ventricular fibrillation are detected only after one or more attempts with shock therapy are unsuccessful in terminating the ventricular fibrillation.

16. The method of claim 12 further comprising delivering a diaphragmatic pacing pulse during a ventricular refractory period after a ventricular sense if respiratory arrest is detected while no ventricular fibrillation is present.

5 17. The method of claim 11 further comprising:

beginning to charge an output capacitor of the ventricular shock channel when ventricular fibrillation is detected and to deliver a diaphragmatic pacing pulse while the output capacitor is charging if respiratory arrest is also detected; and,

10 delivering a diaphragmatic pacing pulse during a ventricular refractory period after a ventricular sense if respiratory arrest is detected after successful termination of ventricular fibrillation.